What is claimed is:

1. A method of forming an image sensor device, comprising the steps of:

forming an image sensing array in a substrate, wherein the image sensing array comprises a plurality of photosensors with spaces therebetween;

forming a first dielectric layer overlying the spaces but not the photosensors;

forming a conformal second dielectric layer on a sidewall of the first dielectric layer, wherein the second dielectric layer has a second refractive index; and

forming a third dielectric layer overlying the photosensors but not the spaces, wherein the third dielectric layer has a third refractive index;

wherein the third refractive index is greater than the second refractive index.

2. The method according to claim 1, wherein the photosensors are photodiodes.

3. The method according to claim 2, wherein the photodiodes comprise n-type regions in p-type regions.

4. The method according to claim 1, wherein the method of forming the first dielectric layer, the second dielectric layer and the third dielectric layer comprises the steps of:

forming the first dielectric layer overlying the photosensors and the spaces;

patterning the first dielectric layer by removing part of the first dielectric layer to form an opening above

each photosensor while maintaining the first dielectric layer overlying the spaces;

forming a dielectric layer on the first dielectric layer and an inner surface of the opening;

anisotropically etched back part of the dielectric layer to form the second dielectric layer on the sidewall of the opening;

forming the third dielectric layer overlying the first dielectric layer, the second dielectric layer and the opening; and

removing part of the third dielectric layer to the first dielectric layer while maintaining the third dielectric layer in the opening.

5. The method according to claim 4, wherein the step of patterning the first dielectric layer uses the same reticle that is used for defining ion implantation regions for the photosensors.

6. The method according to claim 4, further comprising the step of:

performing a planarization to make the top surfaces of the first dielectric layer, the second dielectric layer and the third dielectric layer are coplanar.

7. The method according to claim 6, wherein the planarization comprises chemical mechanical polishing.

8. The method according to claim 1, wherein the first dielectric layer comprises at least one interlevel dielectric (ILD) layer.

9. The method according to claim 8, wherein the first dielectric layer further comprises at least one intermetal dielectric (IMD) layer.

10. The method according to claim 9, wherein the IMD layer has multiple dielectric films.

11. The method according to claim 10, wherein the multiple dielectric films comprise SiON, SiN and FSG (Fluorinated Silica Glass) films.

12. The method according to claim 11, wherein the second dielectric layer is a low-k dielectric layer.

13. The method according to claim 12, wherein the low-k dielectric layer is a FLARE, SiLK, FLAC (fluorinated amorphous silicon), fluoro polymer or porous silica layer.

14. The method according to claim 13, wherein the third dielectric layer is a TEOS-SiO_2 layer formed by PECVD.

15. The method according to claim 1, wherein the third refractive index is greater than the second refractive index by at least about 0.1.

16. A method of forming an image sensor device, comprising the steps of:

forming an image sensing array in a substrate, wherein the image sensing array comprises a plurality of photosensors with spaces therebetween;

forming a first dielectric layer of a multi-dielectric structure overlying the photosensors and the spaces;

patterning the first dielectric layer by removing part of the first dielectric layer to form an opening above each photosensor while maintaining the first dielectric layer overlying the spaces;

forming a dielectric layer on the first dielectric layer and an inner surface of the opening;

anisotropically etched back part of the dielectric layer to form a conformal second dielectric layer on the sidewall of the opening, wherein the second dielectric layer has a second refractive index;

forming a third dielectric layer overlying the first dielectric layer, the second dielectric layer and the opening, wherein the third dielectric layer has a third refractive index; and

removing part of the third dielectric layer to the first dielectric layer while maintaining the third dielectric layer in the opening;

wherein the third refractive index is greater than the second refractive index;

wherein a light guide comprising the second dielectric layer and the third dielectric layer is formed overlying each photosensor, thereby preventing incident light from striking other photosensors.

17. The method according to claim 16, wherein the photosensors are photodiodes.

18. The method according to claim 17, wherein the photodiodes comprise n-type regions in p-type regions.

19. The method according to claim 16, wherein the step of patterning the first dielectric layer uses the same reticle that is used for defining ion implantation regions for the photosensors.

20. The method according to claim 16, further comprising the step of:

performing planarization to make the top surfaces of the first dielectric layer, the second dielectric layer, and the third dielectric layer coplanar.

21. The method according to claim 20, wherein the planarization comprises chemical mechanical polishing.

22. The method according to claim 16, wherein the multi-dielectric structure comprises SiON, SiN and FSG (Fluorinated Silica Glass) films.

23. The method according to claim 22, wherein the second dielectric layer is a low-k dielectric layer.

24. The method according to claim 23, wherein the low-k dielectric layer is a FLARE, SiLK, FLAC (fluorinated amorphous silicon), fluoro polymer or porous silica layer.

25. The method according to claim 24, wherein the third dielectric layer is a TEOS-SiO_2 layer formed by PECVD.

26. The method according to claim 16, wherein the third refractive index is greater than the second refractive index by at least about 0.1.

27. The method according to claim 16, wherein a thickness of the second dielectric layer is 200~2000Å.

28. An image sensor device, comprising:

an image sensing array in a substrate, wherein the image sensing array comprises a plurality of photosensors with spaces therebetween;

a first dielectric layer overlying the spaces but not the photosensors;

a conformal second dielectric layer on a sidewall of the first dielectric layer, wherein the second dielectric layer has a second refractive index; and

a third dielectric layer overlying the photosensors but not the spaces, wherein the third dielectric layer has a third refractive index;

wherein the third refractive index is greater than the second refractive index.

29. The device according to claim 28, wherein the photosensors are photodiodes.

30. The device according to claim 29, wherein the photodiodes comprise n-type regions in p-type regions.

31. The device according to claim 28, wherein top surfaces of the first dielectric layer, the second dielectric layer and the third dielectric layer are coplanar.

32. The device according to claim 28, wherein the first dielectric layer comprises at least one interlevel dielectric (ILD) layer.

33. The device according to claim 32, wherein the ILD layer is a silicon oxide or BPSG (borophosphosilicate glass) layer.

34. The device according to claim 32, wherein the first dielectric layer further comprises at least one intermetal dielectric (IMD) layer.

35. The device according to claim 34, wherein the IMD layer has multiple dielectric films.

36. The device according to claim 35, wherein the multiple dielectric films comprise SiON, SiN and FSG (Fluorinated Silica Glass) films.

37. The device according to claim 36, wherein the second dielectric layer is a low-k dielectric layer.

38. The device according to claim 37, wherein the low-k dielectric layer is a FLARE, SiLK, FLAC (fluorinated amorphous silicon), fluoro polymer or porous silica layer.

39. The device according to claim 38, wherein the third dielectric layer is a TEOS-SiO_2 layer formed by PECVD.

40. The device according to claim 28, wherein the third refractive index is greater than the second refractive index by at least about 0.1.

41. The device according to claim 28, wherein a thickness of the second dielectric layer is 200~2000Å.